

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 06-081057

(43)Date of publication of application : 22.03.1994

(51)Int.Cl.

C22C 9/00
B23K 3/02
B23K 11/30

(21)Application number : 04-232315

(71)Applicant : NIPPON STEEL CORP

(22)Date of filing : 31.08.1992

(72)Inventor : NISHIMURA SATORU
SHIODA KOSAKU
ENDO MICHIO

(54) CU-FE ALLOY FOR WELDING ELECTRODE AND SOLDERING IRON TIP
EXCELLENT IN MOLTEN METAL CORROSION RESISTANCE AND STRENGTH AT HIGH
TEMPERATURE AND ITS PRODUCTION

(57)Abstract:

PURPOSE: To provide a Cu-Fe alloy for welding electrode and soldering iron tip, having high electric conductivity and excellent, particularly, in molten metal corrosion resistance.

CONSTITUTION: This alloy is an alloy having a composition consisting of, by weight, 5-30% Fe, 0.0005-1.0% Co, 0.005-3.5% Ti, 0.5-10% Cr, 0.001-1.5% Mo, and the balance Cu with inevitable impurities. The alloy is melted, cast, and subjected to solution heat treatment at 700-1000°C, followed by aging treatment at 300-650°C for 100-1000min.

LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's
decision of rejection]

[Date of requesting appeal against examiner's
decision of rejection]

[Date of extinction of right]

Copyright (C); 1998,2003 Japan Patent Office

*** NOTICES ***

JPO and NCIPI are not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

CLAIMS

[Claim(s)]

[Claim 1] Fe: A welding electrode and the Cu-Fe alloy for a soldering iron chip excellent in the molten-metal-proof corrosion nature and high temperature strength which are characterized by containing 5-30 % of the weight, Co:0.0005-1.0 % of the weight, Ti:0.005-3.5 % of the weight, Cr:0.5-10 % of the weight, and Mo:0.001-1.5 % of the weight, and the remainder consisting of an unescapable impurity and Cu.

[Claim 2] The welding electrode according to claim 1 and the Cu-Fe alloy for a soldering iron chip whose weight ratio of Cr content to Fe content is 5.5 - 13.5%.

[Claim 3] The welding electrode according to claim 1 or 2 and the Cu-Fe alloy for a soldering iron chip which contain one sort of Zr, Si, aluminum, nickel, Zn, Sn, Nb, P, La, Ce, Y, V, calcium, Be, Mg, or Hf, or two sorts or more in total, and contain one sort of C or B, or two sorts 0.005 to 2% of the weight in total 0.005 to 8% of the weight further as an alloy content.

[Claim 4] The manufacture approach of the welding electrode excellent in the molten-metal-proof corrosion nature and high temperature strength which carry out solution treatment of the alloy of an effective dose according to claim 1, 2, or 3 at the temperature of 700-1000 degrees C after dissolution casting, and are characterized by performing aging treatment for 100 - 1000 minutes at the temperature of 300-650 degrees C after an appropriate time, and the Cu-Fe alloy for a soldering iron chip.

[Translation done.]

*** NOTICES ***

JPO and NCIP are not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]**[0001]**

[Industrial Application] This invention has high conductivity (thermal conductivity), and relates to the welding electrode and the Cu-Fe alloy for a soldering iron chip which were especially excellent in molten-metal-proof corrosion nature (resistance to the phenomenon of diffusion of the molten metal by the side of solid phase and the solid phase in a liquid phase interface arising when molten metal is contacted on an ingredient front face, and degrading the ingredient front face by the side of solid phase), and high temperature strength.

[0002]

[Description of the Prior Art] Conventionally, generally, the electrical and electric equipment and thermal conductivity are good, and it excels in high temperature strength and molten-metal-proof corrosion nature, and deformation resistance (high temperature strength) and non-joining nature are provided in members, such as a resistance welding electrode, and a soldering iron chip, a contact tip, and the still cheaper thing is needed for them. It is that to which invention of a publication performed amelioration of the reinforcement of chromium copper (Cu alloy containing 1.5 or less % of the weight of Cr), and molten-metal-proof corrosion nature to JP,60-39140,B and JP,62-19263,B from this. Moreover, although it is developed in order that invention of JP,58-186103,A may improve said property further by compound addition of Zr and Fe (0.12 - 1.2 % of the weight) About the problem of deformation by the point consumption and high temperature strength by quality-of-the-material degradation in the chip tip at the time of the resistance welding in a galvanized steel sheet or a tinning steel plate and the solder corrosion of a soldering iron chip being low, it is not yet improved enough and the extensive improvement of a use life is not made.

[0003]

[Problem(s) to be Solved by the Invention] This invention possesses the outstanding property as these welding electrode and a charge of soldering iron chip material, and aims at offering the alloy which makes reinforcement possible.

[0004]

[Means for Solving the Problem] Then, this invention persons examine the optimal component of Cu radical alloy for maintaining high conductivity (thermal conductivity) and improving sharply molten-metal-proof corrosion nature and high temperature strength to coincidence to the above-mentioned technical problem. When Zn, Sn, and Sn-Pb are put on Y of a Cu-X-Y system component, it is the element repelled due to the interaction parameter in thermodynamics, and based on a header and this knowledge, this invention was completed for the addition alloy element which is further contributed to high temperature strength greatly and which is materialized industrially. That is, it is in the summary of this invention containing Fe:5-30 % of the weight, Co:0.0005-1.0 % of the weight, Ti:0.005-3.5 % of the weight, Cr:0.5-10 % of the weight, and Mo:0.001-1.5 % of the weight, carrying out solution treatment of the alloy

with which the remainder consists of an unescapable impurity and Cu at the temperature of 700-1000 degrees C after the dissolution and casting, and performing aging treatment for 100 - 1000 minutes at the temperature of 300-650 degrees C after an appropriate time.

[0005]

[Function] The reason for limitation of the requirements for a configuration of this invention is explained below. In order to acquire high conductivity by this invention, it is so desirable that the content of Cu is high, but in order to improve sharply the molten-metal-proof corrosion nature and high temperature strength of main properties of this invention, as shown in drawing 1, since said effectiveness is not acquired at less than 5 % of the weight, the content of Fe makes this a minimum. Moreover, an upper limit will be made into 30 % of the weight because conductivity (more than 70%IACS) required for this development ingredient is not acquired, therefore if Fe is super-^{**}(ed) 30% of the weight, it will make Fe 5 - 30 % of the weight.

[0006] In addition, the amount decrement of melting Zn Nakashige in drawing displays the weight decrement after being immersed in the 500-degree C melting Zn for 1 hour, after carrying out surface grinding of the material which the addition of Cu and Fe was changed and was cast to 30mm board thickness by dissolution casting by the coil grinder. Specifying Co to 0.0005 - 1.0% of the weight below has little effectiveness to high temperature strength at less than 0.0005%, and it is because the effectiveness to high temperature strength is saturated with ^{**} upwards 1.0% of the weight and cost becomes large. Moreover, specifying Ti to 0.005 - 3.5% of the weight has little effectiveness to conductivity at less than 0.005%, and it is because the effectiveness to conductivity is saturated with ^{**} upwards 3.5% of the weight and manufacturability, such as casting and cold-working nature, is checked.

[0007] Moreover, Mo is specified to 0.001 - 1.5% of the weight for raising molten-metal-proof corrosion nature by the compound effectiveness with Cr, at less than 0.001 % of the weight, the effectiveness to molten-metal-proof corrosion nature has few contents of Mo, the effectiveness to molten-metal-proof corrosion nature is saturated with ^{**} upwards 1.5% of the weight, and cost becomes large. Furthermore, Cr is specified to 5.5 - 13.5% of the weight in Fe phase for raising molten-metal-proof corrosion nature by the compound effectiveness with said Mo, and at less than 5.5 % of the weight, since the effectiveness to molten-metal-proof corrosion nature is saturated upwards and the homogeneity of an organization etc. is degraded even if that effectiveness is insufficient and exceeds 13.5 % of the weight, it limits to this range.

[0008] It is desirable to the improvement of cast structure control, improvement in high temperature strength, etc. to add one sort of C or B or two sorts for one sort of Zr, Si, aluminum, nickel, Zn, Sn, Nb, P, La, Ce, Y, V, calcium, Be, Mg, or Hf or two sorts or more in 0.005 - 2% of the weight of the range 0.005 to 8% of the weight furthermore. Fe phase and Cu phase containing Cr and Mo of this development technique are important for 6 % of the weight and Mo content being 0.005-% of the weight or more above-mentioned within the limits, and adding Si, aluminum, Ti, Zr, La, Ce, Y, Hf, C, B, etc. especially, for control of a homogeneity organization of the component of which Cr content in Fe exceeds 0.01 % of the weight, when obtaining the cast structure minutely distributed by homogeneity.

[0009] Next, the welding electrode of this invention and the manufacture approach as a charge of soldering iron chip material are explained. After casting after dissolving the alloy which has the above-mentioned chemical entity and performing solution treatment for 10 - 180 minutes in a 700-1000-degree C temperature requirement, surface grinding is carried out as occasion demands, and aging treatment for 100 - 1000 minutes is performed after an appropriate time in a 300-650-degree C temperature requirement.

[0010] Since the amount of dissolutions of the above-mentioned component before aging treatment is increased for the purpose of depositing an addition component minutely, solution treatment is performed. Said detailed deposit is performed by aging treatment. Therefore, the

combination of this the processing of both is important when acquiring the outstanding reinforcement and high conductivity. In addition, since hot rolling of 30 - 95% of rolling reduction can be performed in 700-1000 degrees C after casting when adding aluminum in 5 - 8 % of the weight, and the high range, the cast metal plate of 20-250mm of board thickness can be used, and improvement in ***** can be carried out also with a volume and the yield.

[0011]

[Example]

The chemical composition of alloy A-C of the component range of this invention, N-FF, and D-M of the component range of comparative is shown in the example 1. table 1.

[0012]

[Table 1]

*比較成分

供試材	Cu	Fe	Cr	Ti	Co	Mo	その他の 元素	100Cr/Fe (%)
A	Balance	6.5	0.6	1.0	0.001	0.01		9.2
B	Balance	12.3	1.3	0.8	0.002	0.03		10.6
C	Balance	25.5	2.1	0.3	0.001	0.01		8.2
* D	Balance	4.5	0.6	0.5	0.003	0.02		13.3
* E	Balance	35.5	3.8	0.5	0.002	0.02		10.7
* F	Balance	12.3	1.5	0.5	0.0002	0.01		12.2
* G	Balance	12.5	1.5	0.5	1.21	0.02		12.0
* H	Balance	12.3	1.5	0.007	0.002	0.02		12.2
* I	Balance	12.5	1.5	3.8	0.003	0.01		12.0
* J	Balance	12.6	1.3	0.2	0.002	0.0005		10.3
* K	Balance	12.3	1.5	0.5	0.002	1.65		12.2
* L	Balance	12.3	0.65	0.5	0.003	0.02		5.3
* M	Balance	12.5	2.1	0.5	0.002	0.02		17.0
N	Balance	12.5	1.5	0.5	0.002	0.02	Zr:0.35	12.0
O	Balance	12.6	1.2	0.5	0.002	0.01	Si:0.15	9.5
P	Balance	12.6	1.5	0.3	0.002	0.01	Al:1.02	11.9
Q	Balance	12.3	1.5	0.3	0.003	0.02	Ni:0.63	12.2
R	Balance	12.5	1.5	0.3	0.002	0.01	Zn:0.35	12.0
S	Balance	12.6	1.3	0.5	0.003	0.01	Sn:0.30	10.3
T	Balance	12.3	1.5	0.5	0.003	0.01	Nb:0.50	12.2
U	Balance	12.3	1.5	0.5	0.002	0.02	P:0.75	12.2
V	Balance	12.6	1.5	0.5	0.002	0.02	La:0.80	11.9
W	Balance	12.5	1.2	0.5	0.002	0.01	Ce:0.68	9.6
X	Balance	12.3	1.5	0.3	0.001	0.02	Y:0.72	12.2
Y	Balance	12.3	1.3	0.5	0.002	0.01	V:0.63	10.6
Z	Balance	12.3	1.5	0.3	0.002	0.02	Ca:1.05	12.2
AA	Balance	12.3	1.3	0.5	0.002	0.02	Be:0.67	10.6
BB	Balance	12.3	1.5	0.5	0.003	0.01	Mg:0.53	12.2
CC	Balance	12.3	1.5	0.3	0.002	0.02	Hf:0.21	12.2
DD	Balance	12.3	1.5	0.5	0.002	0.02	C:0.32	12.2
EE	Balance	12.3	1.5	0.5	0.002	0.01	B:0.002	12.2
FF	Balance	12.5	1.0	0.3	0.002	0.01	Al:6.02	12.5

[0013] After casting the molten metal which has the chemical composition shown in A-EE of Table 1 in a dissolution vacuum ambient atmosphere with high-frequency-induction-heating

equipment to the steel plate of 20mm of board thickness with a level continuous casting machine; At 1000 degrees C, after [20 minutes] carrying out solution treatment, carry out water cooling, and a coil grinder performs surface grinding, and it is processed into a 15mm steel plate. After casting similarly the molten metal which has the chemical composition shown in table 1FF about the ingredient which performed aging treatment of 6 hours at 550 degrees C after that to the metal plate of 30mm of board thickness, Hot-roll to 15mm of board thickness at the temperature of 950 degrees C, and water cooling of the ***** hot-rolling plate is carried out. Or after carrying out the same solution treatment and same water cooling as the above, aging treatment was performed and the result of having performed ordinary temperature, the elevated-temperature (500 degrees C) tension test, the creep-rupture trial, the conductometry trial, and Melting Zn and a melting Sn immersion test, respectively was shown in Table 2 about the obtained ingredient, respectively. Moreover, about thermal conductivity, it evaluated with electrical conductivity from the relation between electrical conductivity and equivalence.

[0014] In addition, the tension test performed the JISNo. 13 B test piece by the creep-rupture trial. That is, the load was changed for this test piece at the temperature of 300 degrees C, that fracture life was measured, and the load which serves as a fracture life of 1000 hours from that result was searched for as creep-rupture reinforcement. Moreover, conductometry was performed by 4 terminal method, further, it removed Sn or Zn which took out the with a diameter die length [25mm die length of 10mm] obtained by machining during each 500-degree C bath of a Melting [Zn] and the 400-degree C melting Sn test piece from each bath after being immersed for 1 hour, and adhered to the front face with the hydrochloric acid 50%, measured the mass decrement in the state of ***** , and evaluated molten-metal-proof corrosion nature by Melting Zn and the melting Sn immersion test. Cr copper (0.8-% of the weight Cr addition copper alloy) plate of 15mm of board thickness, the Cu-0.09-% of the weight Zr-0.58-% of the weight Fe-0.18-% of the weight P alloy plate, and the Cu-6.01-% of the weight Cr-0.17-% of the weight Zr-0.23-% of the weight P alloy plate were further used for front Naka as an example of a comparison.

[0015]

[Table 2]

[016]

[11 11 3]

*比較例

試料 番号	供 試材		強 度 (kgf/mm ²)		伸 び (%)		クリープ ラプチャ ー強度 (kgf/mm ²)	導電率 %IACS	熔融金属浸 食量 (g)	
			室温	500℃	室温	500℃			Zn	Sn
1	A	本発明	82	82	23	23	56	86	0.28	0.10
2	B	本発明	88	88	22	22	57	82	0.23	0.07
3	C	本発明	90	90	20	20	63	72	0.13	0.05
* 4	D	比較例	65	63	23	23	45	86	0.32	0.26
* 5	E	比較例	102	102	22	22	68	52	0.23	0.07
* 6	F	比較例	73	52	20	20	50	73	0.13	0.05
* 7	G	比較例	88	88	23	23	57	75	0.22	0.07
* 8	H	比較例	80	80	22	22	58	58	0.23	0.06
* 9	I	比較例	80	80	23	23	57	86	0.23	0.07
*10	J	比較例	80	80	22	22	58	80	0.32	0.28
*11	K	比較例	80	80	20	20	57	82	0.23	0.07
*12	L	比較例	80	80	23	23	56	81	0.38	0.27
*13	M	比較例	80	80	22	22	58	82	0.22	0.06
14	N	本発明	81	81	23	23	58	81	0.22	0.07
15	O	本発明	82	82	22	22	57	82	0.23	0.07
16	P	本発明	83	83	20	20	58	81	0.23	0.07
17	Q	本発明	80	80	23	23	57	82	0.22	0.07
18	R	本発明	81	81	22	22	56	81	0.23	0.06
19	S	本発明	82	82	23	23	58	82	0.23	0.07
20	T	本発明	83	83	22	22	57	81	0.22	0.07

[0016]

[Table 3]

(表2のつゞき)

試料 番号	供 試材		強 度 (kgf/mm ²)		伸 び (%)		クリープ ラプチャ ー強度 (kgf/mm ²)	導電率 %IACS	溶融金属侵 食量 (g)	
			室温	500℃	室温	500℃			Zn	Sn
21	U	本発明	82	82	20	20	58	82	0.23	0.07
22	V	本発明	82	82	23	23	57	81	0.23	0.07
23	W	本発明	83	83	22	22	56	82	0.22	0.06
24	X	本発明	83	83	23	23	58	81	0.23	0.07
25	Y	本発明	80	80	22	22	58	82	0.23	0.07
26	Z	本発明	81	81	20	20	58	81	0.23	0.06
27	AA	本発明	82	82	23	23	57	82	0.23	0.07
28	BB	本発明	83	83	22	22	58	81	0.23	0.07
29	CC	本発明	82	82	23	23	57	82	0.23	0.07
30	DD	本発明	82	82	22	22	56	82	0.23	0.07
31	EE	本発明	83	83	22	22	58	81	0.23	0.06
32	FF	本発明	86	86	23	23	58	73	0.20	0.06
Cr銅		比較例	45.0	20.0	23	6.0	16	81	3.52	5.15
Cu-6Cr- 0.17Zr- 0.23P		比較例	65.0	35.0	18	17.0	42	62	0.43	0.26
Cu-0.09Zr -0.58Fe- 0.18P		比較例	68.0	38.0	20	18.0	48	82	0.52	0.36

[0017] Each Cu-Fe alloy of this invention has 70% or more of high conductivity, and a high-temperature-strength property, creep-rupture reinforcement, and molten-metal-proof corrosion nature were excellent compared with the comparison alloy so that clearly from Tables 2 and 3. Moreover, the sample number 9 had poor cold-working nature, and since cast structure was an ununiformity, the quality of a sample number 13 of a product was uneven [the sample number]. Moreover, since there were many contents of Co and Mo respectively, sample numbers 7 and 11 had the high manufacturing cost.

[0018] Table 4 – this invention Cu-Fe alloys A, B, C, N, O, and FF of Table 1, Cr copper alloy of the example of a comparison, and Cu-2-% of the weight aluminum 203 The electrode for spot welding was created from the alloy, in order to investigate an electrode life, the continuation spot welding trial was performed, and the result was shown. Welding materials-ed performed spot welding using the welder of rated capacity 25KVA using the melting galvanized steel sheet (double-sided plating, amount of superintendent officers 45 g/m²-one side) of 0.8mm of board thickness by part for welding current 10000A, welding-pressure [of 250kg], 10 cycle weld-time, and 20-RBI/. Evaluation of an electrode life was evaluated with the number of RBIs when the diameter of a nugget amounts to below 4t (t: board thickness) every 100 RBIs.

[0019]

[Table 4]

試料番号	供試材		電 極 寿 命 回 数
3 3	A	本 発 明	7 8 0 0
3 4	B	本 発 明	8 2 0 0
3 5	C	本 発 明	8 5 0 0
3 6	N	本 発 明	8 7 0 0
3 7	O	本 発 明	8 6 0 0
3 8	FF	本 発 明	8 6 0 0
C r 銅		比 較 例	1 2 0 0
C u - A l ₂ O ₃ 合 金		比 較 例	3 2 0 0

[0020] Furthermore, from the Cu-Fe alloys A, B, C, N, O, and FF of this invention, and the usual Cu alloy, the conic soldering iron chip with an acute point with a diameter of 10mm was manufactured, and a chip front face was not processed, but it soldered in 1 cycle 5 seconds with the welding pressure of 600g at the chip tip temperature of 450 degrees C, and life test of a chip was performed. The result was shown in Table 5. Moreover, the point of deformation was remarkable and the judgment of life test of a chip used the count at the time of soldering becoming impossible.

[0021]

[Table 5]

試料番号	供試材		半田ごて寿命回数
3 9	A	本 発 明	8 0 0 0 0
4 0	B	本 発 明	8 5 0 0 0
4 1	C	本 発 明	1 0 0 0 0 0
4 2	N	本 発 明	1 2 0 0 0 0
4 3	O	本 発 明	1 0 0 0 0 0
4 4	FF	本 発 明	1 1 0 0 0 0
C u 合 金		比 較 例	3 5 0 0
Cu-6Cr-0.17Zr-0.23P		比 較 例	3 0 0 0 0

[0022]

[Effect of the Invention] The Cu-Fe alloy of this invention has extremely excellent high temperature strength and molten-metal-proof corrosion nature from the above result, and when it uses for a welding electrode and a soldering iron chip ingredient from excelling in electrical conductivity (thermal conductivity), compared with the conventional material, very useful effectiveness is brought to a industrial cost cut from a long lasting thing.

[Translation done.]

*** NOTICES ***

JPO and NCIPi are not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

TECHNICAL FIELD

[Industrial Application] This invention has high conductivity (thermal conductivity), and relates to the welding electrode and the Cu-Fe alloy for a soldering iron chip which were especially excellent in molten-metal-proof corrosion nature (resistance to the phenomenon of diffusion of the molten metal by the side of solid phase and the solid phase in a liquid phase interface arising when molten metal is contacted on an ingredient front face, and degrading the ingredient front face by the side of solid phase), and high temperature strength.

[Translation done.]

*** NOTICES ***

JPO and NCIPi are not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

PRIOR ART

[Description of the Prior Art] Conventionally, generally, the electrical and electric equipment and thermal conductivity are good, and it excels in high temperature strength and molten-metal-proof corrosion nature, and deformation resistance (high temperature strength) and non-joining nature are provided in members, such as a resistance welding electrode, and a soldering iron chip, a contact tip, and the still cheaper thing is needed for them. It is that to which invention of a publication performed amelioration of the reinforcement of chromium copper (Cu alloy containing 1.5 or less % of the weight of Cr), and molten-metal-proof corrosion nature to JP,60-39140,B and JP,62-19263,B from this. Moreover, although it is developed in order that invention of JP,58-186103,A may improve said property further by compound addition of Zr and Fe (0.12 - 1.2 % of the weight) About the problem of deformation by the point consumption and high temperature strength by quality-of-the-material degradation in the chip tip at the time of the resistance welding in a galvanized steel sheet or a tinning steel plate and the solder corrosion of a soldering iron chip being low, it is not yet improved enough and the extensive improvement of a use life is not made.

[Translation done.]

*** NOTICES ***

JPO and NCIPPI are not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

EFFECT OF THE INVENTION

[Effect of the Invention] The Cu-Fe alloy of this invention has extremely excellent high temperature strength and molten-metal-proof corrosion nature from the above result, and when it uses for a welding electrode and a soldering iron chip ingredient from excelling in electrical conductivity (thermal conductivity), compared with the conventional material, very useful effectiveness is brought to a industrial cost cut from a long lasting thing.

[Translation done.]

*** NOTICES ***

JPO and NCIP are not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] This invention possesses the outstanding property as these welding electrode and a charge of soldering iron chip material, and aims at offering the alloy which makes reinforcement possible.

[Translation done.]

*** NOTICES ***

JPO and NCIP are not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

MEANS

[Means for Solving the Problem] Then, this invention persons examine the optimal component of Cu radical alloy for maintaining high conductivity (thermal conductivity) and improving sharply molten-metal-proof corrosion nature and high temperature strength to coincidence to the above-mentioned technical problem. When Zn, Sn, and Sn-Pb are put on Y of a Cu-X-Y system component, it is the element repelled due to the interaction parameter in thermodynamics, and based on a header and this knowledge, this invention was completed for the addition alloy element which is further contributed to high temperature strength greatly and which is materialized industrially. That is, it is in the summary of this invention containing Fe:5-30 % of the weight, Co:0.0005-1.0 % of the weight, Ti:0.005-3.5 % of the weight, Cr:0.5-10 % of the weight, and Mo:0.001-1.5 % of the weight, carrying out solution treatment of the alloy with which the remainder consists of an unescapable impurity and Cu at the temperature of 700-1000 degrees C after the dissolution and casting, and performing aging treatment for 100 - 1000 minutes at the temperature of 300-650 degrees C after an appropriate time.

[Translation done.]

*** NOTICES ***

JPO and NCIP are not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

OPERATION

[Function] The reason for limitation of the requirements for a configuration of this invention is explained below. In order to acquire high conductivity by this invention, it is so desirable that the content of Cu is high, but in order to improve sharply the molten-metal-proof corrosion nature and high temperature strength of main properties of this invention, as shown in drawing 1, since said effectiveness is not acquired at less than 5 % of the weight, the content of Fe makes this a minimum. Moreover, an upper limit will be made into 30 % of the weight because conductivity (more than 70% IACS) required for this development ingredient is not acquired, therefore if Fe is super-**(ed) 30% of the weight, it will make Fe 5 - 30 % of the weight.

[0006] In addition, the amount decrement of melting Zn Nakashige in drawing displays the weight decrement after being immersed in the 500-degree C melting Zn for 1 hour, after carrying out surface grinding of the material which the addition of Cu and Fe was changed and was cast to 30mm board thickness by dissolution casting by the coil grinder. Specifying Co to 0.0005 - 1.0% of the weight below has little effectiveness to high temperature strength at less than 0.0005%, and it is because the effectiveness to high temperature strength is saturated with ** upwards 1.0% of the weight and cost becomes large. Moreover, specifying Ti to 0.005 - 3.5% of the weight has little effectiveness to conductivity at less than 0.005%, and it is because the effectiveness to conductivity is saturated with ** upwards 3.5% of the weight and manufacturability, such as casting and cold-working nature, is checked.

[0007] Moreover, Mo is specified to 0.001 - 1.5% of the weight for raising molten-metal-proof corrosion nature by the compound effectiveness with Cr, at less than 0.001 % of the weight, the effectiveness to molten-metal-proof corrosion nature has few contents of Mo, the effectiveness to molten-metal-proof corrosion nature is saturated with ** upwards 1.5% of the weight, and cost becomes large. Furthermore, Cr is specified to 5.5 - 13.5% of the weight in Fe phase for raising molten-metal-proof corrosion nature by the compound effectiveness with said Mo, and at less than 5.5 % of the weight, since the effectiveness to molten-metal-proof corrosion nature is saturated upwards and the homogeneity of an organization etc. is degraded even if that effectiveness is insufficient and exceeds 13.5 % of the weight, it limits to this range.

[0008] It is desirable to the improvement of cast structure control, improvement in high temperature strength, etc. to add one sort of C or B or two sorts for one sort of Zr, Si, aluminum, nickel, Zn, Sn, Nb, P, La, Ce, Y, V, calcium, Be, Mg, or Hf or two sorts or more in 0.005 - 2% of the weight of the range 0.005 to 8% of the weight furthermore. Fe phase and Cu phase containing Cr and Mo of this development technique are important for 6 % of the weight and Mo content being 0.005-% of the weight or more above-mentioned within the limits, and adding Si, aluminum, Ti, Zr, La, Ce, Y, Hf, C, B, etc. especially, for control of a homogeneity organization of the component of which Cr content in Fe exceeds 0.01 % of the weight, when obtaining the cast structure minutely distributed by homogeneity.

[0009] Next, the welding electrode of this invention and the manufacture approach as a charge

of soldering iron chip material are explained. After casting after dissolving the alloy which has the above-mentioned chemical entity and performing solution treatment for 10 - 180 minutes in a 700-1000-degree C temperature requirement, surface grinding is carried out as occasion demands, and aging treatment for 100 - 1000 minutes is performed after an appropriate time in a 300-650-degree C temperature requirement.

[0010] Since the amount of dissolutions of the above-mentioned component before aging treatment is increased for the purpose of depositing an addition component minutely, solution treatment is performed. Said detailed deposit is performed by aging treatment. Therefore, the combination of this the processing of both is important when acquiring the outstanding reinforcement and high conductivity. In addition, since hot rolling of 30 - 95% of rolling reduction can be performed in 700-1000 degrees C after casting when adding aluminum in 5 - 8 % of the weight, and the high range, the cast metal plate of 20-250mm of board thickness can be used, and improvement in ***** can be carried out also with a volume and the yield.

[Translation done.]

*** NOTICES ***

JPO and NCIP are not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

EXAMPLE

[Example]

The chemical composition of alloy A-C of the component range of this invention, N-FF, and D-M of the component range of comparative is shown in the example 1. table 1.

[0012]

[Table 1]

*比較成分

供試材	Cu	Fe	Cr	Ti	Co	Mo	その他の 元素	100Cr/Fe (%)
A	Balance	6.5	0.6	1.0	0.001	0.01		9.2
B	Balance	12.3	1.3	0.8	0.002	0.03		10.6
C	Balance	25.5	2.1	0.3	0.001	0.01		8.2
* D	Balance	4.5	0.6	0.5	0.003	0.02		13.3
* E	Balance	35.5	3.8	0.5	0.002	0.02		10.7
* F	Balance	12.3	1.5	0.5	0.0002	0.01		12.2
* G	Balance	12.5	1.5	0.5	1.21	0.02		12.0
* H	Balance	12.3	1.5	0.007	0.002	0.02		12.2
* I	Balance	12.5	1.5	3.8	0.003	0.01		12.0
* J	Balance	12.6	1.3	0.2	0.002	0.0005		10.3
* K	Balance	12.3	1.5	0.5	0.002	1.65		12.2
* L	Balance	12.3	0.65	0.5	0.003	0.02		5.3
* M	Balance	12.5	2.1	0.5	0.002	0.02		17.0
N	Balance	12.5	1.5	0.5	0.002	0.02	Zr:0.35	12.0
O	Balance	12.6	1.2	0.5	0.002	0.01	Si:0.15	9.5
P	Balance	12.6	1.5	0.3	0.002	0.01	Al:1.02	11.9
Q	Balance	12.3	1.5	0.3	0.003	0.02	Ni:0.63	12.2
R	Balance	12.5	1.5	0.3	0.002	0.01	Zn:0.35	12.0
S	Balance	12.6	1.3	0.5	0.003	0.01	Sn:0.30	10.3
T	Balance	12.3	1.5	0.5	0.003	0.01	Nb:0.50	12.2
U	Balance	12.3	1.5	0.5	0.002	0.02	P:0.75	12.2
V	Balance	12.6	1.5	0.5	0.002	0.02	La:0.80	11.9
W	Balance	12.5	1.2	0.5	0.002	0.01	Ce:0.68	9.6
X	Balance	12.3	1.5	0.3	0.001	0.02	Y:0.72	12.2
Y	Balance	12.3	1.3	0.5	0.002	0.01	V:0.63	10.6
Z	Balance	12.3	1.5	0.3	0.002	0.02	Ca:1.05	12.2
AA	Balance	12.3	1.3	0.5	0.002	0.02	Be:0.67	10.6
BB	Balance	12.3	1.5	0.5	0.003	0.01	Mg:0.53	12.2
CC	Balance	12.3	1.5	0.3	0.002	0.02	Hf:0.21	12.2
DD	Balance	12.3	1.5	0.5	0.002	0.02	C:0.32	12.2
EE	Balance	12.3	1.5	0.5	0.002	0.01	B:0.002	12.2
FF	Balance	12.5	1.0	0.3	0.002	0.01	Al:6.02	12.5

[0013] After casting the molten metal which has the chemical composition shown in A-EE of Table 1 in a dissolution vacuum ambient atmosphere with high-frequency-induction-heating equipment to the steel plate of 20mm of board thickness with a level continuous casting machine, At 1000 degrees C, after [20 minutes] carrying out solution treatment, carry out water cooling, and a coil grinder performs surface grinding, and it is processed into a 15mm steel plate. After casting similarly the molten metal which has the chemical composition shown in table 1FF about the ingredient which performed aging treatment of 6 hours at 550 degrees C after that to the metal plate of 30mm of board thickness, Hot-roll to 15mm of board thickness at the temperature of 950 degrees C, and water cooling of the ***** hot-rolling plate is carried out. Or after carrying out the same solution treatment and same water cooling as the above, aging treatment was performed and the result of having performed ordinary temperature, the elevated-temperature (500 degrees C) tension test, the creep-rupture trial, the conductometry trial, and Melting Zn and a melting Sn immersion test, respectively was shown in Table 2 about

the obtained ingredient, respectively. Moreover, about thermal conductivity, it evaluated with electrical conductivity from the relation between electrical conductivity and equivalence.

[0014] In addition, the tension test performed the JISNo. 13 B test piece by the creep-rupture trial. That is, the load was changed for this test piece at the temperature of 300 degrees C, that fracture life was measured, and the load which serves as a fracture life of 1000 hours from that result was searched for as creep-rupture reinforcement. Moreover, conductometry was performed by 4 terminal method, further, it removed Sn or Zn which took out the with a diameter die length [25mm die length of 10mm] obtained by machining during each 500-degree C bath of a Melting [Zn] and the 400-degree C melting Sn test piece from each bath after being immersed for 1 hour, and adhered to the front face with the hydrochloric acid 50%, measured the mass decrement in the state of *****, and evaluated molten-metal-proof corrosion nature by Melting Zn and the melting Sn immersion test. Cr copper (0.8-% of the weight Cr addition copper alloy) plate of 15mm of board thickness, the Cu-0.09-% of the weight Zr-0.58-% of the weight Fe-0.18-% of the weight P alloy plate, and the Cu-6.01-% of the weight Cr-0.17-% of the weight Zr-0.23-% of the weight P alloy plate were further used for front Naka as an example of a comparison.

[0015]

[Table 2]

[0016]

[Table 3]

*比較例

試料 番号	供 試 材		強 度 (kgf/mm ²)		伸 び (%)		クリープ ラプチャ ー強度 (kgf/mm ²)	導電率 %IACS	溶融金属浸 食量 (g)	
			室温	500℃	室温	500℃			Zn	Sn
1	A	本発明	82	82	23	23	56	86	0.28	0.10
2	B	本発明	88	88	22	22	57	82	0.23	0.07
3	C	本発明	90	90	20	20	63	72	0.13	0.05
* 4	D	比較例	65	63	23	23	45	86	0.32	0.26
* 5	E	比較例	102	102	22	22	68	52	0.23	0.07
* 6	F	比較例	73	52	20	20	50	73	0.13	0.05
* 7	G	比較例	88	88	23	23	57	75	0.22	0.07
* 8	H	比較例	80	80	22	22	58	58	0.23	0.06
* 9	I	比較例	80	80	23	23	57	86	0.23	0.07
*10	J	比較例	80	80	22	22	58	80	0.32	0.28
*11	K	比較例	80	80	20	20	57	82	0.23	0.07
*12	L	比較例	80	80	23	23	56	81	0.38	0.27
*13	M	比較例	80	80	22	22	58	82	0.22	0.06
14	N	本発明	81	81	23	23	58	81	0.22	0.07
15	O	本発明	82	82	22	22	57	82	0.23	0.07
16	P	本発明	83	83	20	20	58	81	0.23	0.07
17	Q	本発明	80	80	23	23	57	82	0.22	0.07
18	R	本発明	81	81	22	22	56	81	0.23	0.06
19	S	本発明	82	82	23	23	58	82	0.23	0.07
20	T	本発明	83	83	22	22	57	81	0.22	0.07

[0016]
[Table 3]

(表2のつゞき)

試料 番号	供 試材		強 度 (kgf/mm ²)		伸 び (%)		クリープ ラプチャ ー強度 (kgf/mm ²)	導電率 %IACS	溶融金属侵 食量 (g)	
			室温	500℃	室温	500℃			Zn	Sn
21	U	本発明	82	82	20	20	58	82	0.23	0.07
22	V	本発明	82	82	23	23	57	81	0.23	0.07
23	W	本発明	83	83	22	22	56	82	0.22	0.06
24	X	本発明	83	83	23	23	58	81	0.23	0.07
25	Y	本発明	80	80	22	22	58	82	0.23	0.07
26	Z	本発明	81	81	20	20	58	81	0.23	0.06
27	AA	本発明	82	82	23	23	57	82	0.23	0.07
28	BB	本発明	83	83	22	22	58	81	0.23	0.07
29	CC	本発明	82	82	23	23	57	82	0.23	0.07
30	DD	本発明	82	82	22	22	56	82	0.23	0.07
31	EE	本発明	83	83	22	22	58	81	0.23	0.06
32	FF	本発明	86	86	23	23	58	73	0.20	0.06
Cr銅		比較例	45.0	20.0	23	6.0	16	81	3.52	5.15
Cu-6Cr- 0.17Zr- 0.23P		比較例	65.0	35.0	18	17.0	42	62	0.43	0.26
Cu-0.09Zr -0.58Fe- 0.18P		比較例	68.0	38.0	20	18.0	48	82	0.52	0.36

[0017] Each Cu-Fe alloy of this invention has 70% or more of high conductivity, and a high-temperature-strength property, creep-rupture reinforcement, and molten-metal-proof corrosion nature were excellent compared with the comparison alloy so that clearly from Tables 2 and 3. Moreover, the sample number 9 had poor cold-working nature, and since cast structure was an ununiformity, the quality of a sample number 13 of a product was uneven [the sample number]. Moreover, since there were many contents of Co and Mo respectively, sample numbers 7 and 11 had the high manufacturing cost.

[0018] Table 4 -- this invention Cu-Fe alloys A, B, C, N, O, and FF of Table 1, Cr copper alloy of the example of a comparison, and Cu-2-% of the weight aluminum 203 The electrode for spot welding was created from the alloy, in order to investigate an electrode life, the continuation spot welding trial was performed, and the result was shown. Welding materials-ed performed spot welding using the welder of rated capacity 25KVA using the melting galvanized steel sheet (double-sided plating, amount of superintendent officers 45 g/m²-one side) of 0.8mm of board thickness by part for welding current 10000A, welding-pressure [of 250kg], 10 cycle weld-time, and 20-RBI/. Evaluation of an electrode life was evaluated with the number of RBIs when the diameter of a nugget amounts to below 4t (t: board thickness) every 100 RBIs.

[0019]

[Table 4]

試料番号	供試材		電 極 寿 命 回 数
3 3	A	本 発 明	7 8 0 0
3 4	B	本 発 明	8 2 0 0
3 5	C	本 発 明	8 5 0 0
3 6	N	本 発 明	8 7 0 0
3 7	O	本 発 明	8 6 0 0
3 8	FF	本 発 明	8 6 0 0
C r 銅		比 較 例	1 2 0 0
C u - A l ₂ O ₃ 合 金		比 較 例	3 2 0 0

[0020] Furthermore, from the Cu-Fe alloys A, B, C, N, O, and FF of this invention, and the usual Cu alloy, the conic soldering iron chip with an acute point with a diameter of 10mm was manufactured, and a chip front face was not processed, but it soldered in 1 cycle 5 seconds with the welding pressure of 600g at the chip tip temperature of 450 degrees C, and life test of a chip was performed. The result was shown in Table 5. Moreover, the point of deformation was remarkable and the judgment of life test of a chip used the count at the time of soldering becoming impossible.

[0021]

[Table 5]

試料番号	供試材		半田ごて寿命回数
3 9	A	本 発 明	8 0 0 0 0
4 0	B	本 発 明	8 5 0 0 0
4 1	C	本 発 明	1 0 0 0 0 0
4 2	N	本 発 明	1 2 0 0 0 0
4 3	O	本 発 明	1 0 0 0 0 0
4 4	FF	本 発 明	1 1 0 0 0 0
C u 合 金		比 較 例	3 5 0 0
Cu-6Cr-0.17Zr-0.23P		比 較 例	3 0 0 0 0

[Translation done.]

*** NOTICES ***

JPO and NCIP are not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

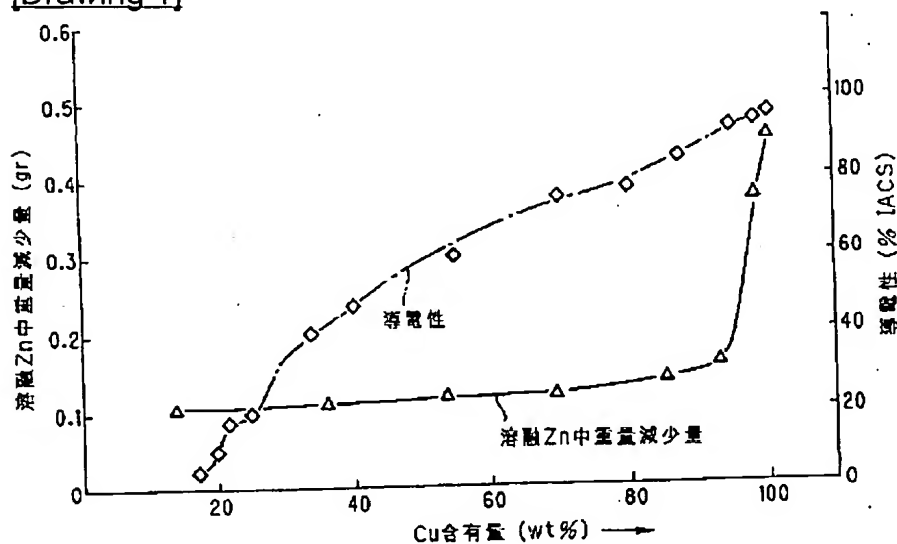
[Drawing 1] It is drawing showing the relation between Fe content, molten-metal-proof corrosion resistance, and conductivity.

[Translation done.]

*** NOTICES ***

JPO and NCIPI are not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

DRAWINGS**[Drawing 1]**

[Translation done.]